

Amendments to the Claims: This listing of claims will replace all prior versions, and listings, of claims in the application

Listing of Claims:

1. (Currently Amended) A brushless DC motor driving method comprising:

a brushless DC motor having a stator and a rotor including a permanent magnet,

an inverter for supplying electric power to the brushless DC motor,

a drive unit for driving the inverter,

a position detecting unit for outputting rotor position signal based on ~~the~~a voltage induced on the stator of the brushless DC motor,

a rotating speed detecting unit for detecting ~~the~~a rotating speed of the brushless DC motor from the rotor position signal,

a first waveform generating unit for outputting drive signal based on the rotor position signal, while performing PWM duty control,

a second waveform generating unit for outputting drive signal driving the brushless DC motor as a synchronous motor, while keeping ~~the~~ PWM duty constant, and

a commutation judging unit for driving the inverter through the drive unit by selecting one of the drive signal from the first waveform generating unit and the drive signal from the second waveform generating unit,

wherein the method comprises the steps of:

~~the commutation judging unit selects the drive signal from the first waveform generating unit during low speed rotation~~

~~when the a rotating speed commanded of the brushless DC motor is under the prescribed rotating speed, and selects smaller than the maximum rotating speed capable of being driven by the drive signal of the first waveform generating unit, driving the inverter by the drive signal outputted from the first waveform generating unit through the drive unit, and~~

~~when a rotating speed commanded of the brushless DC motor is larger than the maximum rotating speed capable of being driven by the drive signal of the first waveform generating unit, driving the inverter first by the drive signal outputted from the first waveform generating unit through the drive unit until reaching the maximum rotating speed capable of being driven by the drive signal of the first waveform generating unit, and then~~

~~the commutation judging unit changing over from driving by the drive signal of the first waveform generating unit to driving by the drive signal from of the second waveform generating unit, during high-speed rotation when and~~

~~the second waveform generating unit changing the frequency while keeping the PWM duty constant, and raising the rotating speed of the brushless DC motor exceeds the prescribed to the rotating speed commanded.~~

2. (Original) The brushless DC motor driving method as defined in Claim 1, wherein the first waveform generating unit outputs a drive signal of a rectangular wave or a waveform similar to it with an conductive angle no less than 120° but no more than 150°, and the second waveform generating unit outputs a drive signal of a rectangular wave or a waveform similar to it with an conductive angle no less than 130° but no more than 180°.

3. (Original) The brushless DC motor driving method as defined in Claim 1, wherein the commutation judging unit equalizes, when it switches the selection between the drive signal from the first waveform generating unit and the drive signal from the second waveform generating unit, the output timing of drive signal before and after the switching.

4. (Original) The brushless DC motor driving method as defined in Claim 1, wherein the commutation judging unit produces, when it switches the selection between the drive signal from the first waveform generating unit and the drive signal from the second waveform generating unit, a difference in the output timing of drive signal before and after the switching.

5. (Original) The brushless DC motor driving method as defined in Claim 1, wherein the commutation judging unit has a function of preventing, when it switches the selection between the drive signal from the first waveform generating unit and the drive signal from the second waveform generating unit, increase of the electric current flowing through the brushless DC motor.

6. (Original) The brushless DC motor driving method as defined in Claim 1, wherein the brushless DC motor comprises the rotor having saliency with a construction in which a permanent magnet is embedded in the rotor core.

7. (Original) The brushless DC motor driving method as defined in Claim 1, wherein the brushless DC motor drives a compressor.

8. (Currently Amended) A brushless DC motor driving ~~apparatus~~method, comprising:

a brushless DC motor having a stator and a rotor including a permanent magnet,

an inverter for supplying electric power to the brushless DC motor,

a drive unit for driving the inverter,

a position detecting unit for outputting rotor position signal based on ~~the~~a voltage induced on the stator of the brushless DC motor,

a rotating speed detecting unit for detecting ~~the~~a rotating speed of the brushless DC motor from the rotor position signal,

a first waveform generating unit for outputting drive signal based on the rotor position signal, while performing PWM duty control,

a second waveform generating unit for outputting drive signal driving the brushless DC motor as a synchronous motor, while keeping controlling the frequency with the PWM duty kept constant, and

a commutation judging unit for ~~driving the inverter through~~

selecting the drive unit signal of with drive signal output by the first waveform generating unit during low speed operation when for driving the inverter by the drive signal outputted from the first waveform generating unit through the drive unit when the rotating speed commanded of the brushless DC motor is under the prescribed smaller than the maximum rotating speed, but capable of driving being driven the inverter through the drive unit with by the drive signal of the first waveform generating unit,

selecting the drive signal of the first waveform generating unit until reaching the maximum rotating speed capable of being driven by the drive signal of the first waveform generating unit when the rotating speed commanded of the brushless DC motor is larger than the maximum rotating speed capable of being driven by the drive signal of the first waveform generating unit, and

changing over from driving by the drive signal of the first waveform generating unit to driving by the drive signal output by of the second waveform generating unit during high speed operation when the when reaching the maximum rotating speed of the brushless DC motor exceeds the prescribed rotating speed capable of being driven by the drive signal of the first waveform generating unit.

9. (Currently Amended) The brushless DC motor driving apparatus method as defined in Claim 8, further comprising:

with a frequency setting unit, ~~for~~ setting the frequency of output waveform from the second waveform generating unit, and

with a frequency limiting unit, ~~for~~ limiting the frequency set by the frequency setting unit so that the frequency of output waveform from the second waveform generating unit may not exceed the upper limit frequency.

10. (Currently Amended) The brushless DC motor driving ~~apparatus~~method as defined in Claim 9, comprising:

with an upper limit frequency setting unit, ~~for~~ setting the upper limit frequency based on the maximum frequency of the waveform from the first waveform generating unit.

11. (Currently Amended) The brushless DC motor driving ~~apparatus~~method as defined in Claim 9, wherein the first waveform generating unit outputs a drive signal of a rectangular wave or a waveform similar to it with an conductive angle no less than 120° but no more than 150°, and the second waveform generating unit outputs a drive signal of a rectangular wave or a waveform similar to it with an conductive angle no less than 130° but no more than 180° at a frequency determined by the frequency setting unit.

12. (Currently Amended) The brushless DC motor driving ~~apparatus~~method as defined in Claim 10, further comprising:

with an upper limit frequency changing unit, ~~for~~ resetting the upper limit frequency, after the brushless DC motor is operated for prescribed time with the drive signal output from the second waveform generating unit.

13. (Currently Amended) The brushless DC motor driving ~~apparatus~~method as defined in Claim 9, further comprising:

with a voltage detecting unit, ~~for~~ detecting the output voltage supplied to the inverter, and

with an upper limit frequency correcting unit, ~~for~~ correcting the upper limit frequency based on the voltage value detected by the voltage detecting unit.

14. (Currently Amended) The brushless DC motor driving ~~apparatus~~method as defined in Claim 9, further comprising:

with a current detecting unit, ~~for~~-detecting the output current of the inverter, and

with a phase difference detecting unit, ~~for~~-changing the upper limit frequency based on the phase of the output voltage of the output current detected by the current detecting unit.

15. (Currently Amended) The brushless DC motor driving ~~apparatus~~method as defined in Claim 9, further comprising:

with a current detecting unit, ~~for~~-detecting the output current of the inverter, and

with an amplitude detecting unit, ~~for~~-changing the upper limit frequency based on the amplitude of the output current detected by the current detecting unit.

16. (Currently Amended) The brushless DC motor driving ~~apparatus~~method as defined in Claim 8, further comprising:

with a frequency setting unit, ~~for~~-setting the frequency of the drive signal output by the second waveform generating unit, and

with a frequency commanding unit, ~~for~~-instructing the frequency of the rotating speed detected by the rotating speed detecting unit to the frequency setting unit.

17. (Currently Amended) The brushless DC motor driving ~~apparatus~~method as defined in Claim 8, further comprising:

with a frequency setting unit, ~~for~~-setting the frequency of the drive signal output by the second waveform generating unit, and

with ~~an~~ coincidence judging unit, ~~for~~-judging if the detecting timing of the rotating speed detecting unit coincides with the output timing of the second waveform generating unit and,

if coincidence is confirmed, instructing the frequency set by the frequency setting unit as output frequency to the first waveform generating unit.

18. (Currently Amended) The brushless DC motor driving ~~apparatus~~method as defined in Claim 8, comprising:

with a frequency correcting unit, ~~for~~ correcting the frequency of rotating speed detected by the rotating speed detecting unit, and instructing it as output frequency to the frequency setting unit.

19. (Currently Amended) The brushless DC motor driving ~~apparatus~~method as defined in Claim 8, comprising:

with a deviation judging unit, ~~for~~ judging if the detecting timing of the position detecting circuit remains within the range of tolerance or not against the output timing of the second waveform generating unit and instructing the frequency set by the frequency setting unit as output frequency to the first waveform generating unit.

20. (Currently Amended) The brushless DC motor driving ~~apparatus~~method as defined in Claim 8, further comprising:

with a stop detecting unit, ~~for~~ detecting if the brushless DC motor is at stop with abnormality or not based on the output signal from the position detecting unit, and

with a protective stopping unit, ~~for~~ stopping the driving of the inverter by the drive unit in case the stop detecting unit detected some unusual stop.

21. (Currently Amended) The brushless DC motor driving ~~apparatus~~method as defined in Claim 20, wherein the motor is constructed in a way to be restarted, after the protective stopping unit stopped the driving of the inverter by the drive unit.

22. (Currently Amended) The brushless DC motor driving ~~apparatus~~method as defined in Claim 8, further comprising:

with an abnormality detecting unit, ~~for~~-detecting abnormality in the rotation of the brushless DC motor based on the position detecting timing of the position detecting unit.

23. (Currently Amended) The brushless DC motor driving ~~apparatus~~method as defined in Claim 22, wherein the abnormality detecting unit detects presence of abnormality in the rotation of the brushless DC motor, in case the position detecting timing of the position detecting unit got out of the prescribed range before and after the "ON" timing of the switching elements of the inverter.

24. (Currently Amended) The brushless DC motor driving ~~apparatus~~method as defined in Claim 22, wherein the commutation judging unit switches, while driving the inverter with the second waveform generating unit, the driving with the second waveform generating unit to driving with the first waveform generating unit, in case the abnormality detecting unit detected some abnormality in the rotation of the brushless DC motor.

25. (Currently Amended) The brushless DC motor driving ~~apparatus~~method as defined in Claim 24, wherein the commutation judging unit switches, after switching the driving with the second waveform generating unit to driving with the first waveform generating unit, following detection of abnormality in the driving of the brushless DC motor by the abnormality detecting unit, if nothing unusual is detected with the rotation of the brushless DC motor.

26. (Currently Amended) The brushless DC motor driving ~~apparatus~~method as defined in Claim 8, further comprising:

with a current detecting unit, ~~for~~-detecting the output current of the inverter,

with an abnormality judging unit, ~~for~~-judging the state of motor rotation based on the current detected by the current detecting unit, and

with a protective stopping unit, ~~for~~-stopping the driving of the inverter by the drive unit in case the abnormality judging unit judged presence of abnormality.

27. (Currently Amended) The brushless DC motor driving ~~apparatus~~method as defined in Claim 8, ~~wherein further comprising driving the a~~ brushless DC motor ~~comprises comprising~~ a rotor having saliency with a construction in which a permanent magnet is embedded in the rotor core.

28. (Currently Amended) The brushless DC motor driving ~~apparatus~~method as defined in Claim 8, ~~wherein further comprising driving a compressor with the~~ brushless DC motor, ~~drives a compressor.~~